CHAPTER 3

PLANTING AND ESTABLISHMENT OF TREES, SHRUBS, GROUND COVERS AND VINES

3-1. General. In this chapter, guidelines, standard practices and techniques for planting and initial care of trees, shrubs, ground covers and vines are discussed. Adherence to these guidelines should result in the successful establishment and healthy growth of plantings. Criteria for selection of plant materials and each step necessary to implement the planting plan are also described.

3-2. Planting seasons. In most parts of the country, the most favorable time for planting is during the inactive, or dormant, period of the plant's cycle. There are certain geographic areas, generally in warm regions, where plants may be moved at almost any time of year. However, even in these areas plants have definite growing cycles. Moving the plant during its active growing period should be avoided whenever possible. Often, the extra stress resulting from moving plants during the wrong season causes them to remain in a weakened condition, showing little or no leaf growth until the following growing season. There is extra expense involved in planting out of season because plants must be handled more carefully and watering must be extended for a longer period. Advice on recommended planting periods for a particular geographic area can be obtained from a County Extension agent, Soil and Water Conservation District office, or state, county, and city park or forest agencies. When moving plants out of season, an anti-desiccant should be used. Anti-desiccants are chemicals which protect plants from excessive moisture loss, thereby reducing shock during transplanting. Anti-desiccants also aid in the prevention of winter-kill, summer scald and disease. The spraying of liquid anti-desiccant on the foliage prior to digging the plant from its original location allows planting or transplanting operations during active growing periods. The most favorable periods for planting are as follows:

a. Temperate zone. Deciduous plants may be moved in the fall after leaves drop but before the ground freezes, or in the spring after the ground thaws but before new leaves appear. In areas with cool summers, evergreens are best planted in the late summer after new growth has hardened-off, or somewhat later in the spring than deciduous plants. Farther south, in the temperate zone where the ground seldom freezes, deciduous plants may be moved whenever they are leafless; evergreens should be moved during the same period.

b. Sub-tropic zone. In sub-tropical areas, no definite planting periods exist and it is possible to move most plants with fair success whenever they are not in a period of vigorous growth. Palms and bamboos are most easily handled in early summer. Oaks, including Live Oaks, are difficult to transplant except during the winter when they are relatively dormant. Even in the subtropics, much is to be gained by planting during cooler months unless plants are container-grown or otherwise handled with special care. For instance, collected wax myrtles planted during hot weather require heavy pruning and usually put out little foliage before the following spring. Planted in winter or spring, wax myrtles will establish easily and will not require much pruning.

3-3. Quality of plants. The most important step in assuring successful planting is to select plants of the highest possible quality. Widely accepted criteria may be found in the American Association of Nurserymen publication, "American Standard for Nursery Stock", ANSI Z60.1. High quality in plant materials is achieved through nursery practices which produce plants with desirable branching characteristics and root systems that are conditioned for successful transplanting. The ANSI standards are accepted throughout the landscape industry and by government agencies. Several additional common sense rules should be applied in selecting plants. Plants should be grown or collected from an area having a climate similar to that of the planting site. This improves the chances for plants becoming established in the new location. Collected plants are often inferior nursery-grown plants in both appearance and ability to survive transplanting because normal nursery practices, such as pruning of tops and roots, fertilizing and cultivation, have not been applied. Collected plants usually have widely branched root systems due to lack of root pruning. Consequently, a large proportion of the root system is lost in transplanting. Collected plants should not be used unless qualified personnel conduct and direct the operation and a lower grade plant is acceptable. No plants, whether nursery-grown or collected, should be considered acceptable if they have bruised bark, broken primary limbs, unbalanced growth, off-color foliage, insect infestation or diseased wood. Plants infested with insects or disease are especially undesirable as they are potentially contagious to nearby vegetation. Any of the above-mentioned characteristics indicate inferior plants

and give rise to future problems during the establishment period.

3-4. Handling and transportation. During handling and transportation, it is important that roots remain moist and tops are not subjected to the drying effects of sun and wind. Scarcely any plant will survive if its roots have once been dried out; most plants are seriously set back by the drying of even the fine root hairs. Exposure of the tops to wind and sun places a demand for extra moisture on plants which cannot be met while the plant is out of the ground; serious injury often results. Moisture can be retained by spraying the branches and foliage with an anti-desiccant prior to digging and by loosely covering the tops. Bare-root plants should be protected from moisture loss by loosely wrapping the roots in wet burlap immediately after they are dug. Care in handling and transportation shortens the time required for plants to become established in a new location.

a. Handling. Other factors being equal, plants grown in containers and removed carefully, so that the root-ball remains intact, start new growth most rapidly. Plants moved with solid, natural balls of earth enclosing most of the roots also recover fair rapidly. Plants moved with bare roots recover more slowly than those handled by the other two methods. The most common methods of handling are described below.

(1) *Container* grown *plants.* Healthy young plants, grown in containers offer ease of handling and better storage life, and they start new growth more rapidly.

(2) *Balled and burlapped plants.* The use of balled and burlapped plants allows for the transplanting of more mature and larger plants to produce an immediate landscape effect. The balling and burlapping operation should be performed under the supervision of trained personnel. The cost of moving plants with natural earth balls is considerable, but this method is the only way to move some types of plants successfully. Plants handled in this manner require less severe pruning, become established more rapidly and need less attention during the establishment period than bare-root plants. Tree spades are designed to dig and trans- port trees without disturbing the roots. There is no need to wrap the rootball since it is contained by the metal plates employed in digging. Use of tree spades is generally restricted to short-haul operations and can produce highly satisfactory results particularly when plants are large and must be moved out of season.

(3) *Bare-root plants.* Plants may also be removed from the ground bare of soil. This is a common practice, especially for small deciduous and seedling evergreen trees. This method should not be used except during the plant's dormant period. Large plants, especially deciduous ones, dug with bare roots require heavy pruning of tops to compensate for the loss of roots and rootlets. The shock of bare-root transplanting is more severe than with other methods and recovery time is longer. Coating roots in very wet clay (puddling) or wrapping them in wet burlap immediately after digging will prevent roots from drying out.

(4) *Collected plants.* Collected deciduous plants can be moved either balled and burlapped or bare-root; except for seedlings, evergreen plants should always be balled and burlapped. Regardless of the method used, collected plants should be root-pruned in place at least one growing season prior to transplanting and plainly tagged for ease of identification.

(5) *Existing vegetation.* The possibility of transplanting existing vegetation should be given careful consideration when making planting plans. Whenever possible, plants to be moved should be root-pruned well in advance of the growing season.

b. Transportation. On or before delivery, plants should be inspected for correct size, type and quantity. They should be examined for damage, insects and wilting. The plants should have no unsightly irregularities and be in satisfactory condition. Plants dropped over the side or off the tailgate of delivery trucks should be rejected, as damage to the root system is highly probable even though it may not be apparent. Delivery should be coordinated with planting operations to avoid prolonged storage on the site. Bare-root plants should be given planting priority because they are most vulnerable to moisture loss. The shorter the time a plant is out of the ground, the better its chances for survival. If it is not possible to plant on the same day as delivery, storage in a protected area and additional watering are necessary.

3-5. Soil and additives. The guidelines in this chapter concern soil and additives for the planting of trees, shrubs, vines and ground covers. More often than not, soil available at the planting site will not be wholly satisfactory for vigorous growth and must be improved by the addition of various materials.

a. Soil. Whenever available, soil for backfilling plant pits or beds should be friable (easily pulverized), fertile topsoil that has a demonstrated capability of sustaining vigorous plant growth. The topsoil should be of a uniform composition, containing no subsoil, twigs, clumps of grass, stones or hard shale larger than one inch, toxic substances or other extraneous material. Soil meeting these general qualifications is usually adequate to sustain healthy plant growth. Good quality topsoil previously stripped from the site and stockpiled prior to grading operations may be used; topsoil from another site located in the general area of the planting project is also acceptable. Stripping of topsoil should be done carefully to avoid stirring up subsoil and mixing it with topsoil. Topsoil to be used should be tested for soil acidity (pH) and organic content by a qualified testing laboratory.

Local agencies such as the State Agricultural Experiment Station, County Extension agents, Soil and Water Conservation District, state university or qualified private organizations may be contacted for information about laboratory soil tests. The laboratory test report will include specific recommendations on materials required to bring the soil to acceptable levels of acidity (pH) and organic content.

b. Additives. Various materials may be needed to improve substandard soil, but precautions should be taken in their use.

(1) *Soil conditioners.* The addition of soil conditioners improves the friability and, except for sand, the moisture-retaining capacity of the soil. Humus (peat), spent manure, sand and commercially available minerals such as vermiculite and perlite can be mixed with planting soil. As a general rule, a mixture of one part sand or mineral soil conditioner, one part humus and one part topsoil will provide a Soil mixture suitable for planting trees and shrubs.

(a) Sand and minerals. Coarse sand and minerals such as vermiculite and perlite are especially useful for making heavy clay soils more friable. Since none of these soil conditioners contain plant nutrients, they should be supplemented with fertilizer. Sand is usually the most readily available and inexpensive material, but is much heavier than mineral conditioners. Vermiculite and perlite are light in weight and should be used for planter boxes or roof gardens where structural load is a significant consideration.

(b) Humus. Humus, in the form of peat moss, rotted sawdust or spent manure, can be added to the soil to provide organic matter and promote healthy plant growth. If peat is not readily available, any decomposed vegetable compost can be used. If the cost of adding commercial humus (peat) to the soil is too high, acceptable results often can be obtained by use of more economical and locally available sources of organic material.

(2) *PH adjusters.* The need for pH adjusters may be indicated by the laboratory test report and recommendations. The pH scale for most soils ranges from 4.0 (strongly acid) to 10.0 (strongly alkaline) with 7.0 being neutral. Most plants absorb nutrients best from soils between pH 6.0 to pH 6.5, whereas lawn grasses thrive at pH 6.5 to pH 7.0. Ericaceous plants are acid-loving and prefer soil which tests at about 6.0. If available soil varies radically from acceptable levels of acidity or alkalinity, pH adjusters can be used. Correct measurement and thorough mixing are essential when adding these materials. Too much acidity in the soil is as harmful to plants as too much alkalinity, even for such ericaceous, broad-leaved evergreens as azaleas and rhododendrons. Lime and sulfur are the most commonly used pH adjusters.

(a) Lime. The addition of lime to the soil reduces acidity. Many woody plants are somewhat tolerant of soil acidity and require no pH adjustment. However, some ornamental plants may require that an alkaline soil condition be maintained. Advice on correct amounts and times for liming can be obtained from a reliable local nursery or County Extension agent.

(b) Sulfur. If soil tests reveal that the soil is too alkaline, it is generally good practice to add sulfur in the form of commercially available, acid-producing compounds. Aluminum sulfate is the most readily available source of sulfur. Again, as with lime, advice should be sought concerning the quantity of chemicals which should be added to achieve the desired pH.

(3) *Fertilizers.* The use of fast-acting fertilizers in the soil mixture at planting time is of little value since plants are not able to use plant food effectively until they become established. Highly soluble plant food may leach away before the plants have recovered sufficiently to use it. In fact, the use of fast-acting fertilizer in the soil at planting time may actually burn or damage plants. It is more effective and safer to use slow-release fertilizer pellets in the soil or to top-dress plant pits and beds with a moderate amount of fertilizer at the time of planting.

(4) *Soil wetting agent*. The addition of a commercially manufactured soil wetting agent increases the ability of heavy clay soils to absorb water. Such an agent is especially useful in large plant containers for increased moisture penetration prior to transplanting. Although the cost may be justified in limited areas such as planter boxes, these wetting agents are not recommended for large scale use. Wetting agents may be applied as an additive dissolved in water or in granular form as part of the planting soil mixture.

3-6. Drainage. Most plants will not survive if the soils surrounding them remain saturated, because roots cannot absorb oxygen and the plants will suffocate. Excess soil water becomes stagnant and the roots of newly set plants often rot. Surface or subsurface drainage must be provided to collect and carry away excess water since most plant species are not capable of enduring prolonged periods under wet soil conditions. Some plants, such as willows, grow better under these circumstances, but they are few in number. Newly set plants are more susceptible to suffocation from excess water than well-established plants. Collection of excess water may be accomplished by either of the methods described below.

a. Surface drainage. Surface drainage in swales or ditches is the most common means of collecting water and providing positive drainage. This method is more economical than subsurface systems. When drainage swales or ditches must be crossed by pedestrian or automobile traffic, it is better to provide subsurface systems. Swales and ditches are difficult to maintain if banks

are too steeply graded.

b. Subsurface drainage. Subsurface drainage systems are the most permanent and effective means of collecting excess water from plant pits and beds. Subsurface drainage systems may consist of French drains, open-joint agricultural tile, perforated agricultural tile or perforated plastic pipe. Collected water can be channeled to a retention pond or dry-well, to the surface by exposing the outlet at a low part of the site, or to a storm sewer system (fig 3-1)

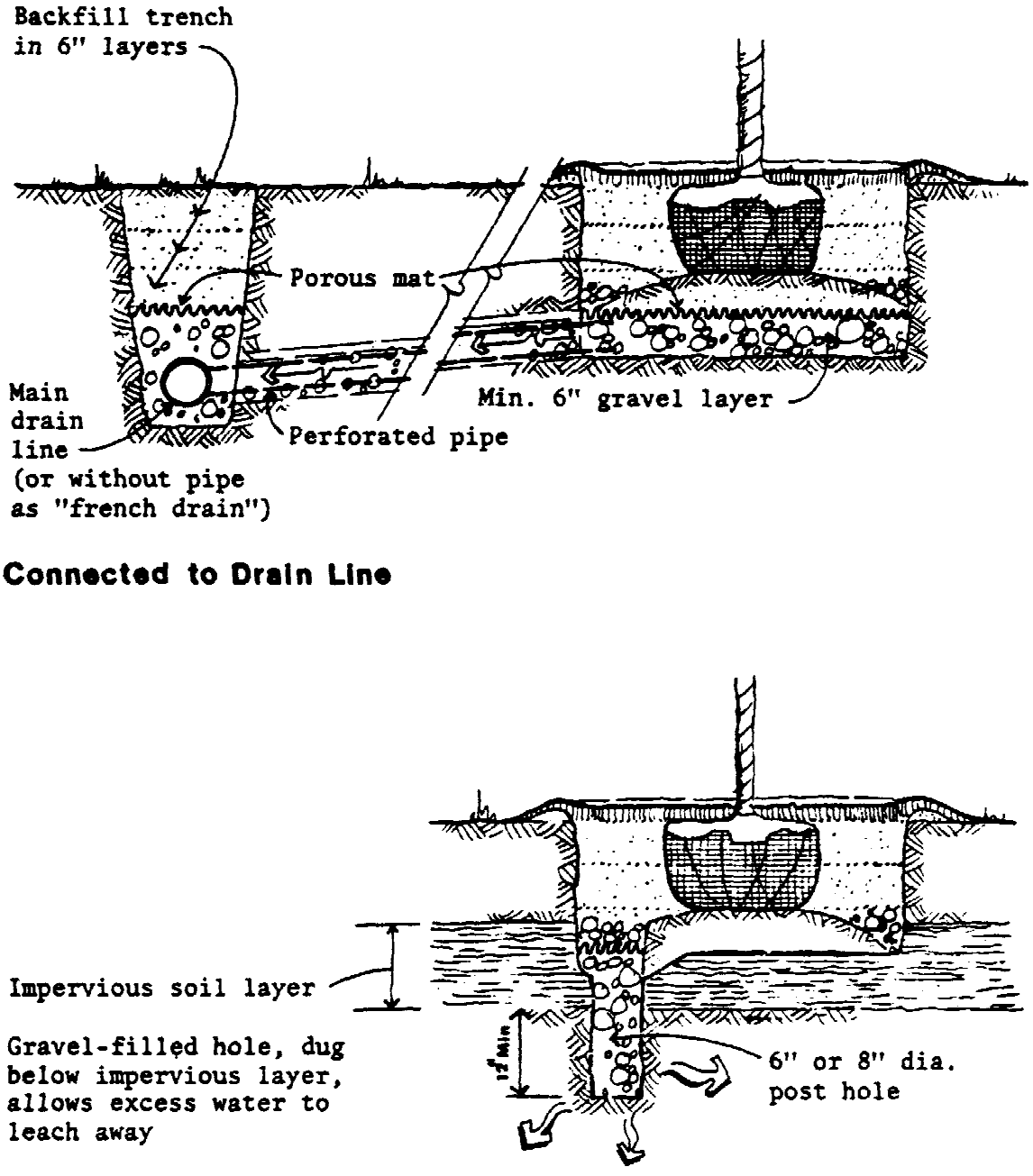

Figure 3-1. Subsurface drainage of plant pits and beds.

3-7. Planting operations. High quality plants, carefully transported and transplanted immediately with adherence to the procedures described below, will usually become established quickly in their new environment.

a. Storage of plants on the site. Plants not planted on the day of arrival at the site should be placed in protected areas and kept moist to prevent drying of roots and tops.

b. Plant Pits and beds. Plant pits and beds should be prepared prior to delivery of the plants to permit immediate planting. Tree pits should be two feet larger than the diameter of the earth ball or the maximum spread of the roots and six inches deeper than the vertical dimension of the earth ball or the maximum depth of the roots. Pits or trenches for shrubs should be dug only one foot wider than the spread of the roots, the diameter of the earth balls or the width of the container and six inches deeper than the vertical dimension of the earth ball container or depth of the roots. If the excavated soil is suitable, it may be used as backfill around the roots or the earth ball. Otherwise, the soil should be removed from the site.

c. Placement of plants. Figure 3-2 illustrates proper planting methods and placement for various types of plants. Generally, plants should be set at such a level that, after settling, they will maintain their original relationship to the ground surface, as indicated by the visible soil line at the base of the trunk. In some cases, plants are set slightly higher or lower than the original ground line to accommodate certain climatic or soil conditions. For example, palms are frequently planted considerably lower in loose, sandy soil for stability in windy locations or to reach a low water table. Most plants, however, cannot tolerate being planted too low and will die if their root crowns are smothered by being covered with excess soil. When planting large trees in recently filled areas where settling is likely to occur, the tree should be placed slightly higher than the surrounding soil. In due course, it will settle and assume its correct relation to the surrounding ground surface. Sometimes, where water tables are high and normal drainage of pits and beds is difficult or uneconomical, trees and shrubs may be planted in earth mounds. However, the relationship of the soil level immediately above the plant's root system should remain as it was prior to transplanting. Planting soil should be prepared and moistened prior to placing plants in the pits or beds. Dry soil should not be used as backfill, but if this is unavoidable, water should be kept running into the pit or bed to saturate the soil and settle it around the roots after planting.

(1) *Setting plants.* Backfill soil should be mounded in the bottom of the pit or bed and tamped to minimize settling and allow firm placement of plants. Each plant should then be held in a vertical position and turned to take advantage of its natural characteristics for best appearance in a given location.

(2) *Future watering.* To facilitate future watering, a saucer-shaped depression should be formed in the soil around individual plants. Where trees are planted in an area surrounded by paving, at least one vertical watering tube should be placed during backfilling to permit watering of the root system. Watering tubes can be 4-inch agricultural tile, 4-inch perforated plastic pipe or 4-inch perforated metal pipe filled to the ground surface with coarse, washed gravel.

d. Pruning. Pruning should be limited to the amount necessary to compensate for the portion of the root system which has been lost during transplanting operations. Evaporation of moisture through the leaves must be reduced to balance with the smaller intake capacity of the roots. If too much moisture is lost, the plant will die or lose its leaves. If defoliation occurs quickly and the leaves do not dry up slowly and hang on, the chances are very good that the plant will send out new leaves after the root system has begun to recover. A safe practice is to cut back the branches of deciduous plants approximately one-third. Pruning of the secondary branches should maintain the natural shape of the tree. The tip end of a tree's main vertical stem or trunk, the leader, should never be cut as this may result in a radical change in the natural growth pattern. Broken and frayed roots should be cut off cleanly above the injuries to minimize the possibility of decay. It is not usually necessary to prune evergreen material at the time of planting, but local practices should be followed. The proper method of pruning is to use well-sharpened equipment to make clean cuts. The pruned surface of branches over one inch in diameter should be treated with commercial tree paint (fig 3-3).

e. Tree wrapping. The trunks of deciduous trees over two inches in caliper should be wrapped with high grade burlap or a commercially prepared tree wrapping paper immediately after planting. The wrapping material should be wound spirally upward around the trunk to the second major branch and secured. Wrapping retards evaporation and prevents sun scald and splitting of the bark.

f. Guying and staking. The primary purpose of guying and staking trees is to prevent excessive movement of the trunk, thus keeping new, fibrous roots from breaking their hold in the surrounding soil. Artificial support is especially necessary for trees with slender, weak trunks, for unusually large shrubs and in areas with adverse wind conditions.

(1) *Methods of Guying.* Trees up to about 5-inch caliper will usually require three guys, each consisting of two strands of 12-gauge wire attached to the tree trunk in such manner as not to injure the bark, and tied at the ground to heavy stakes (deadmen) or commercially available anchors. The bark should be protected from

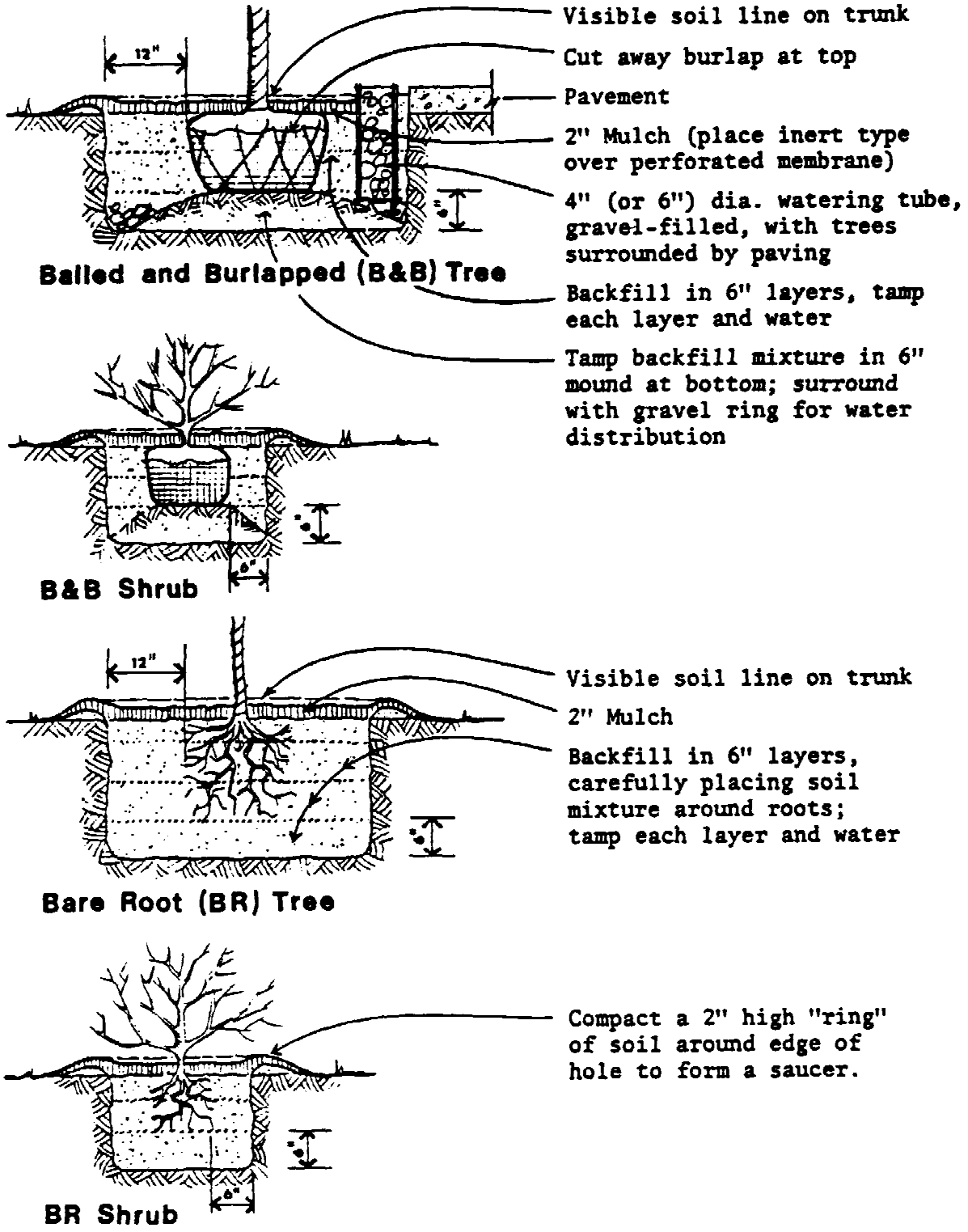

Figure 3-2. Planting methods.

Pruning must be done in a manner which preserves the natural form of the tree or shrub.

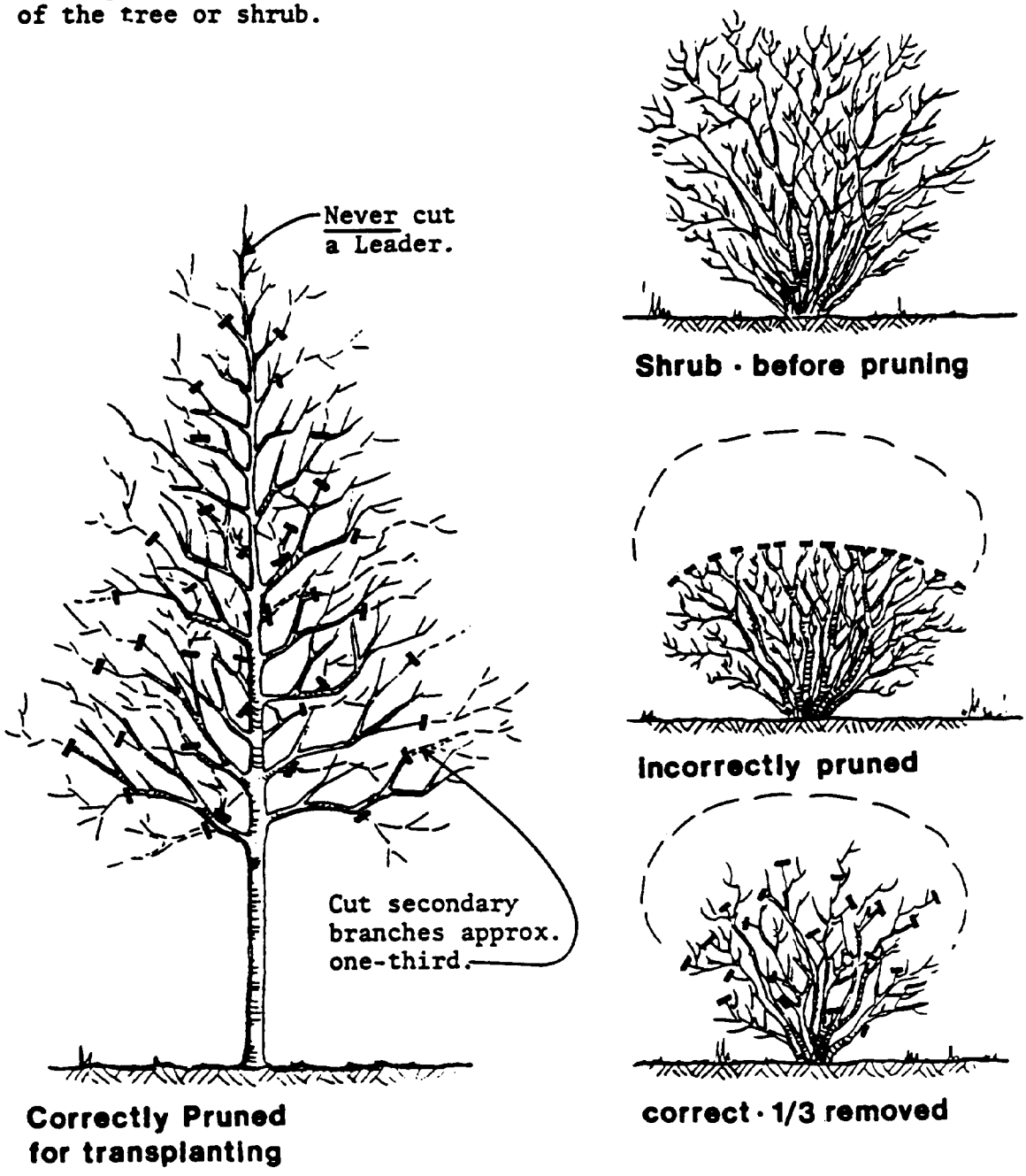

Figure 3-3. Pruning.

serious injury by using short lengths of garden hose to sheath wire. Guys may be tightened by inserting a small piece of wood between them and twisting the two stands of wire together or by the use of turnbuckles. Guying of trees over five inches in diameter may require the use of four guys and more than two strands of wire for each guy, or wire heavier than 12-gauge. In lawns and near paved areas, guys may present a considerable inconvenience or an actual hazard, and colored flags should be tied to them (fig 3-4).

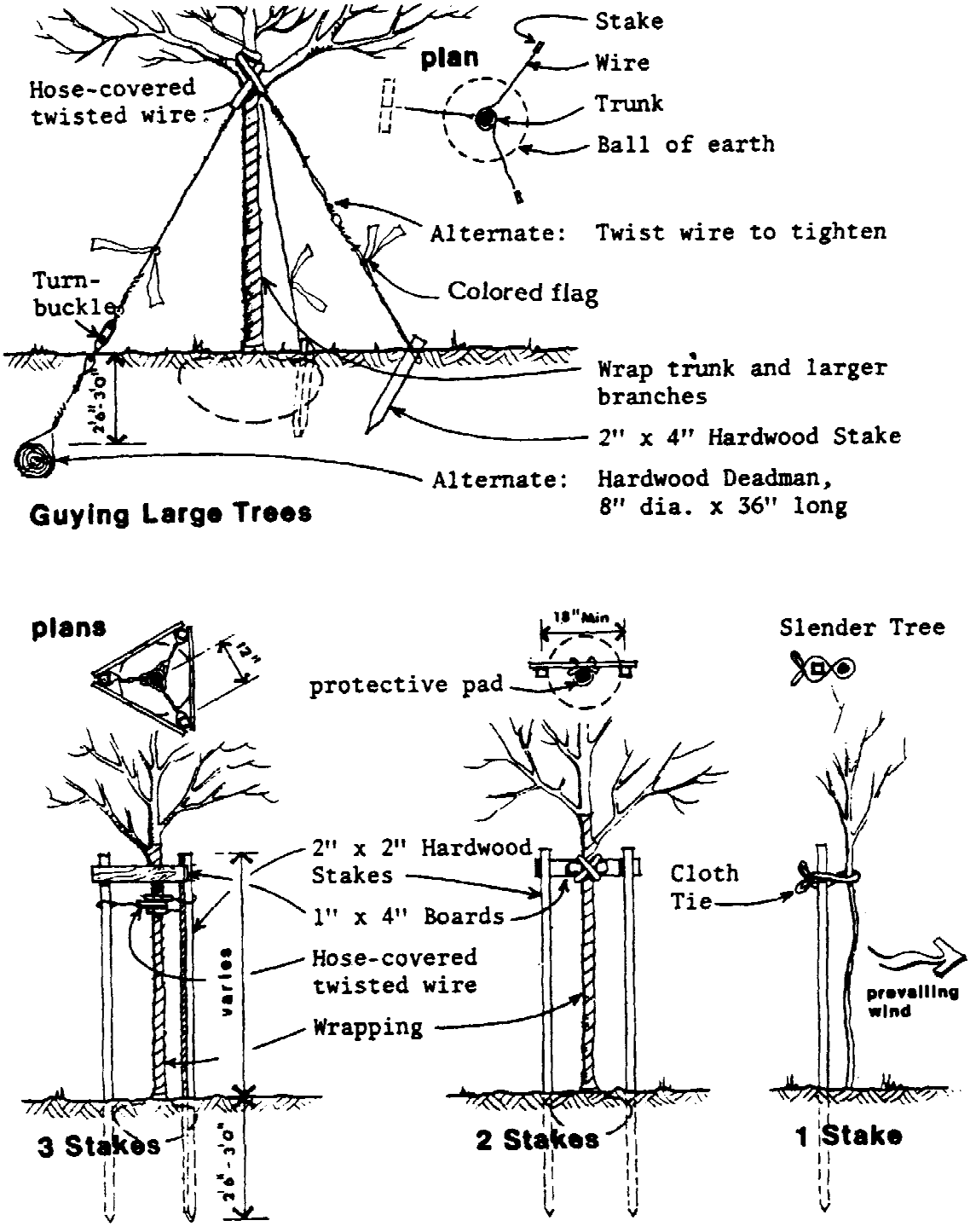

Figure 3-4. Guying and staking.

(2) *Methods of staking.* Staking will furnish adequate support for trees up to about four inches in diameter. A good staking method is to use three 2- by 2-inch stakes, each about 9 feet long, or the equivalent in round natural poles, driven about 1 foot from the outer edges of the root ball in an equilateral triangle to a depth of 2 to 3 feet, and connected at the tops by 1- by 4-inch nailed-on-top braces. Alternate staking methods include the use of two stakes connected to the trunk by 12-gauge wire sheathed in garden hose. When using less than three triangularly-placed stakes, particular attention should be given to the direction of prevailing winds.

(3) *Securing evergreen trees.* Evergreen trees up to **6** feet in height usually do not need support. One stake placed on the windward side of the tree normally will suffice if support is required. Evergreen trees between 7 and 12 feet in height should be guyed and anchored as outlined above for deciduous trees up to 5-inches in caliper. Evergreen trees higher than 12 feet should be guyed and anchored as outlined above for deciduous trees over 5-inches in caliper.

g. Mulching. Mulching is well worth its cost under most circumstances, because it promotes growth and recovery and reduces the frequency of weeding and watering. Mulching retains moisture in the area around plants by adding a loose-textured surface covering that gives shade to the ground beneath and reduces loss of water through evaporation. In colder climates, mulch protects plants from the injurious effects of frequent freezing and thawing. Where stable materials such as shredded bark can hold the soil in place, mulching is a valuable aid for erosion control. Mulch material should be placed over the entire plant pit or bed. Depth of mulch will depend on the material used. Mulches are classified in two principal categories depending on their origin. The first, and most widely used, is organic mulch; the second type is inert, or inorganic. Frequently, mulch is used to add aesthetic appeal to planting areas.

(1) *Organic mulch.* One or two inches of shredded bark will give results equal to four or five inches of marsh hay. Forest litter, wood chips, and, in some localities, industrial by-products such as cocoa bean hulls, nut shells, ground-up corn cobs, rotted sawdust and other organic materials are effective mulches. If fresh sawdust or green vegetative mulch is used, 7.5 pounds of ammonium sulfate or its equivalent should be uniformly mixed into each cubic yard of mulch. This will aid bacterial action and provide nitrogen for the natural decaying process in the sawdust. Otherwise, plants may suffer from lack of nitrogen.

(2) *Inert mulch.* River bank stone, crushed rock, granite or marble chips are visually effective, but a high level of maintenance is usually required to keep the plant pit or beds weed free. Use of a plastic membrane under the inert material is not recommended. Such inert mulches should not be used unless specifically called for on the planting plan, because their use is often a design decision. This is particularly true when colors of gravel or marble are specified.

3-8. Establishment. Maintenance after planting should be frequent and thorough so that no period of neglect will endanger the successful establishment of the plants. During the establishment period, many plants may exhibit abnormal symptoms such as defoliation, off-color foliage, smaller than normal leaves, or lack of flowers or fruit. Sufficient time should be allowed for plants to recover from the trauma of being transplanted. The condition of new plantings should be checked during regular and frequent inspections. The following items should be checked and corrected as needed:

— Do plant beds need water?
— Do plant beds need to be weeded?
— Is there any sign of disease, insect, animal or storm damage?
— Do plants need additional pruning?
— Is mulch in good condition?
— Are guy wires secure?
— Are protective hoses in place around the trees where wires are attached?
— Is tree wrap securely in place?

Maintenance during the establishment period includes watering, weeding and cultivating, fertilizing, control of diseases and insect pests, protection from damage by small animals and pruning, all of which are described below.

a. Watering. Lack of water immediately after planting is extremely dangerous because the reduced root system has difficulty in supplying sufficient moisture to the plant. If the roots are allowed to become too dry, the plant will die. When planting is done during warm weather, the danger is most acute. Planting in the late fall in northern regions is usually successful if plants are heavily watered at the time of planting. In most regions, periodic watering will be required until the plants are firmly established, at least one year after planting. Rain cannot be depended on to supply sufficient moisture to maintain a new planting.

(1) *Sources.* A satisfactory source of water should be determined well in advance of any planting operation. Except in housing complexes and other developed areas, watering from ordinary hose connections may not be feasible. Possible sources of water in undeveloped areas include use of water tank trucks or pumping water from nearby ponds, streams, or wells through portable pipes, canvas hoses, troughs or temporary ditches. In arid regions, permanent underground irrigation systems may be justified. Technical assistance should be sought if such a system is considered feasible and economical.

(2) *Frequency and method.* Soil should be examined regularly and frequently to determine when watering is needed. In warm, dry weather the soil in a new planting can dry out in a surprisingly short time. Water should be applied immediately if soil is dry to the touch a few inches under the surface or if the leaves of plants are wilting. Watering should be thorough and frequent enough to assure that the root zones remain moist during the establishment period. Root balls serve as small reservoirs of available moisture until new roots can draw water from the surrounding soil. To keep moisture from being drawn out of the root balls into dry surrounding soil, water should be applied slowly and allowed to soak into the ground until the surrounding soil reaches field capacity without runoff. This procedure promotes deep root growth, which enables the plant to withstand dry periods and accelerates establishment.

b. Weed control. The area in and around newly-planted trees, shrubs, ground covers and vines should be kept weeded so that plants will not suffer from competition for moisture and plant nutrients. Mulching, as previously mentioned, is highly effective for reducing weed growth and evaporation of soil moisture. Mulch should be maintained at the same depth as when initially placed in the plant pits and beds.

c. Fertilizing. Nitrogen, phosphorus and potassium are the three chief chemical elements required by plants to produce healthy top and root growth. These elements are present in varying amounts in most soils and form the basis for all fertilizers. When plants become established in areas approximating natural conditions, with fallen leaves remaining around them, these elements are returned to the soil and provide adequate natural fertilizer. If plants are surrounded by pavement or located in an area where leaves are raked and removed, there is no natural recycling of chemical elements and they must be replaced periodically by fertilizing. The proper time to begin fertilizing will vary for different kinds of plants and growing conditions, but it is seldom beneficial to begin applications of commercial fertilizers earlier than 6 months after planting. The type, amount and frequency of fertilizer application should be determined on the basis of soil conditions and the size and variety of plants involved. The most effective application method is by means of a grid of holes punched in the root zone, rather than by surface application, so that both shallow and deep roots are reached as quickly as possible without harming surface feeding roots. In general, fertilizers containing a large proportion of phosphorus are desirable because they promote root growth. Slow-acting fertilizers are preferable to fast-acting or soluble fertilizers that leach away rapidly. Fertilizer dissipates more rapidly in highly porous soils. Therefore, applications in sandy soils should be small and frequent. The best time to fertilize is shortly before a natural growing season. Plants should not be forced into lush grow by application of fertilizer during the latter part of a growing season because tender new shoots are more vulnerable to freezing temperatures. Specific recommendations on fertilizers and application methods can be obtained from a local Agricultural Extension agent, state university, Agricultural Experiment Station or similar source.

d. Control of insects and diseases. If plants have been selected with regard to their natural resistance to local insects and diseases, control of infestations will generally be simplified. Planting and maintenance procedures described in this manual will also provide healthy growing conditions which reduce susceptibility of plants to infection. If insect infestation or disease damage occurs, remedial measures should be taken at once. Professional help should be obtained to identify the problem and recommend specific treatment. Depending on the type and size of the affected plant, it is sometimes more expensive to control a disease than it is to replace the plant. Usually an immune cultivar or different type plant should be selected as a replacement because many insects and disease organisms reside in the soil. The best defense against diseases is to keep plants in a healthy condition by applying good maintenance practices during the establishment period and thereafter.

e. Animal damage. Occasionally, animals will chew or gnaw the bark of plants. This weakens the plant's natural defense against diseases and insects. If damage from animals occurs, a commercial pruning paint should be applied to the wound after trimming away any damaged tissue and ragged bark. In localities where Animal damage is likely to occur, protective cages fashioned from wire mesh or window screen may be placed around plants or the base of plants may be painted with a commercial repellent (fig 3-5). Actions to eliminate or relocate problem wildlife species should first be coordinated with local and state wildlife officials.

f. Additional pruning. Plants of good quality should require little additional pruning during the establishment period. Additional pruning usually will be limited to removal of dead or broken branches and some cutting back of shrubs. Pruning should be accomplished by making a clean cut in living wood without bruising tissue or tearing bark and without leaving stubs. Horizontal cuts may heal imperfectly or become rotted and should be avoided. If it is necessary to remove large branches, an initial cut should be made on the bottom of the branch to prevent tearing the bark. All cuts made in branches 1-inch or more in diameter should be painted with a commercial pruning paint.

g. Removal of guy wires, identification tags and tree wrapping. Plants should be inspected periodically to determine if guying and staking devices or identification tags should be loosened. Growth of trunks and branches can cause tight wires to cut into the bark. At the end of

two growing seasons, all guys, stakes and tree wrapping should be removed. Tree wrapping allowed to remain any longer may foster the development of insect infestations on the bark.

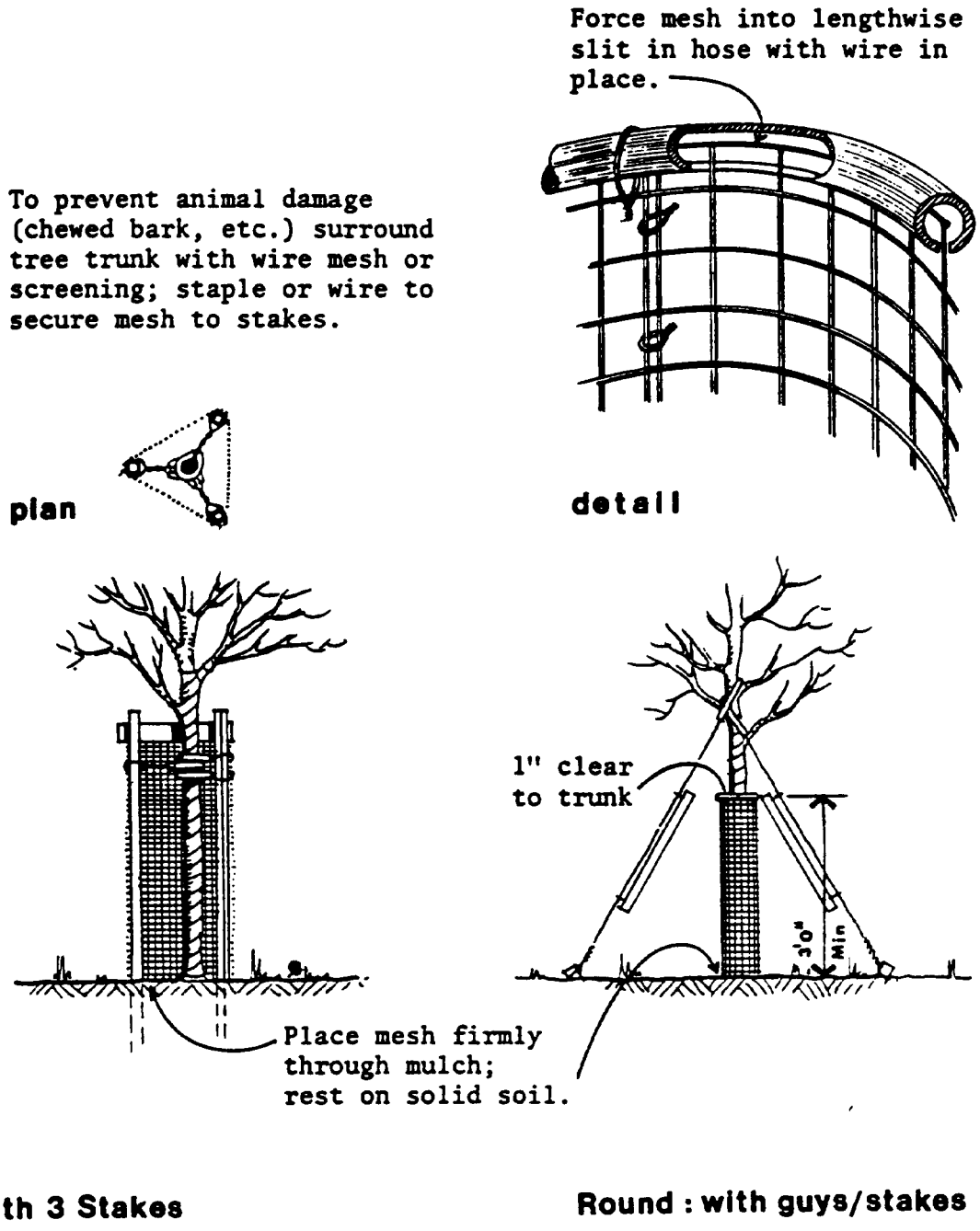

Figure 3-5. Protective cages.